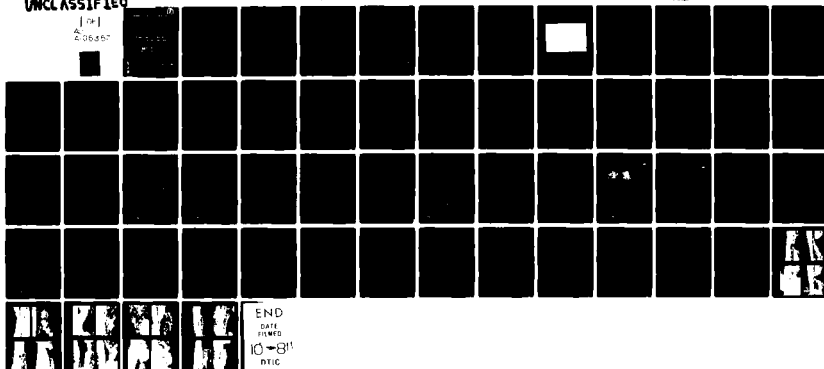


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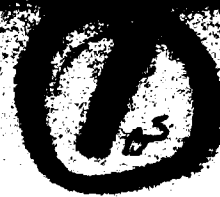
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MISSISSIPPI-KASKASKIA-ST. LOUIS RIVER BASIN

GLEN BASLER LAKE DAM

STE. GENEVIEVE COUNTY, MISSOURI

MO 31382

PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM



United States Army
Corps of Engineers

... Serving the Army
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St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

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4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Basler, Glen Lake Dam (MO 31382) Ste. Genevieve County, Missouri		5. TYPE OF REPORT & PERIOD COVERED (9) Final Report
7. AUTHOR(s) Anderson Engineering, Inc.		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		8. CONTRACT OR GRANT NUMBER(s) (15) DACW43-81-C-ppp5
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14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) (10) Steven L. /Brady Tom R. /Beckley Dave /Daniels Gene /Wertepny		12. REPORT DATE (11) April 1981
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18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety, Lake, Dam Inspection, Private Dams		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.		

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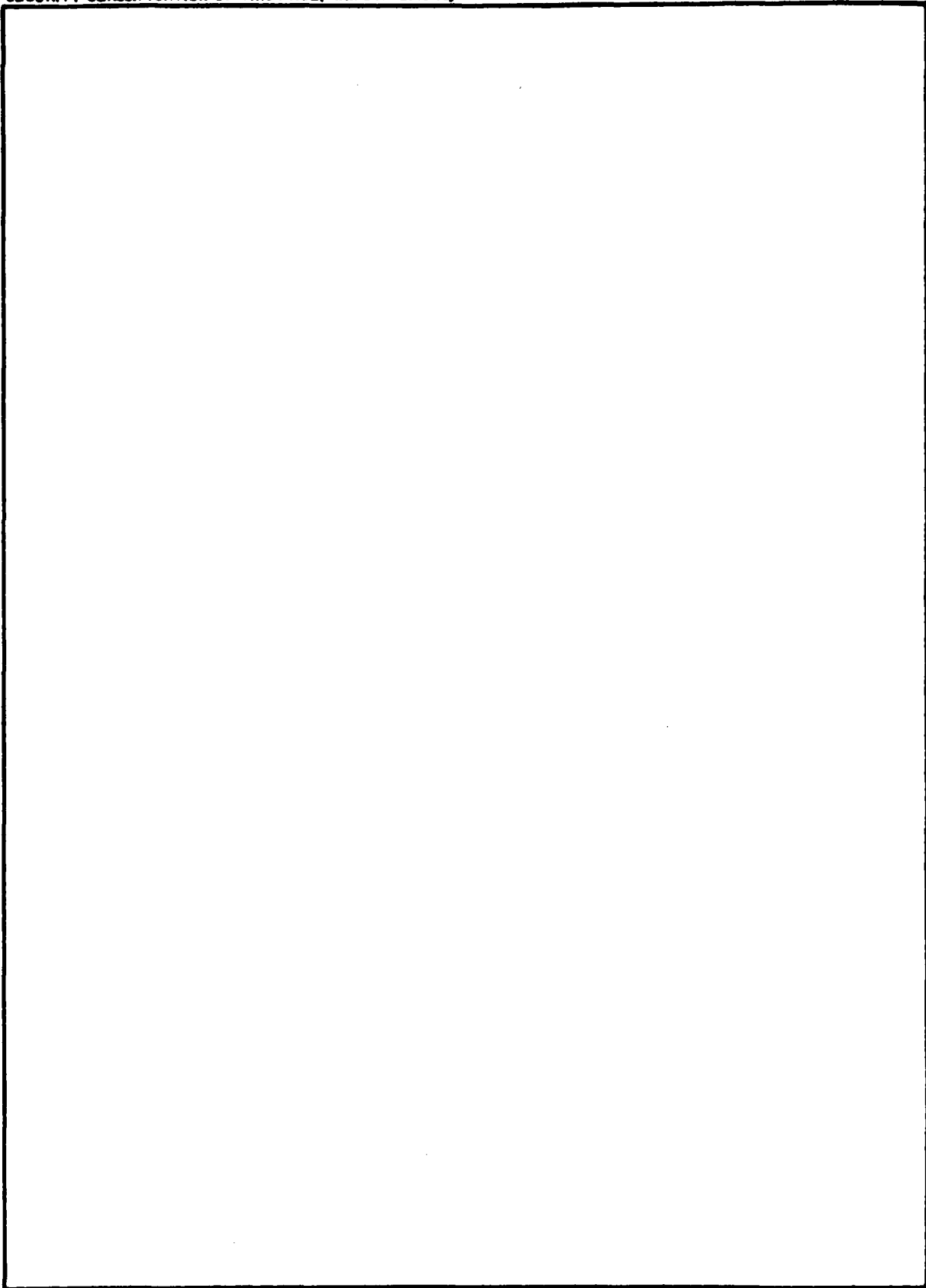
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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD NORTH
ST. LOUIS, MISSOURI 63101

REPORT TO
ATTENTION OF

LMSED-PD

SUBJECT: Glen Basler Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Glen Basler Lake Dam (MO No. 31382).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

- a. Spillway will not pass 50 percent of the Probable Maximum Flood without overtopping the dam.
- b. Overtopping of the dam could result in failure of the dam.
- c. Dam failure significantly increases the hazard to loss of life downstream.

SIGNED

SUBMITTED BY:

Chief, Engineering Division

16 JUL 1981

Date

SIGNED

APPROVED BY:

Colonel, CE, Commanding

17 JUL 1981

Date

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM
SUMMARY

Name of Dam: Glen Basler Lake Dam
State Located: Missouri
County Located: Ste. Genevieve
Stream: Tributary to Little Saline Creek
Date of Inspection: January 29, 1981

✓ Glen Basler Lake Dam was inspected by an interdisciplinary team of engineers, ~~from Anderson Engineering, Inc. of Springfield, Missouri and Hanson Engineers, Inc. of Springfield, Illinois.~~ The purpose of this inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and they have been developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, the St. Louis District, Corps of Engineers has determined that this dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur if the dam fails. The estimated damage zone extends approximately one mile downstream of the dam. Located within this zone are four dwellings, one trailer, several barns and a shed.

✓ The dam is in the small size classification, since it is greater than 25 feet high but less than 40 feet high.

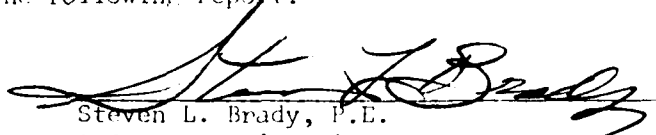
✓ Our inspection and evaluation indicates that the combined spillways do not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The combined spillways will pass 11 percent of the Probable Maximum Flood without overtopping. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The guidelines require that a dam of small size with a high downstream hazard potential pass 50 to 100 percent of the PMF. Considering the low height of the dam (26 feet) and the small storage capacity (41 acre-feet) 50 percent of the PMF has been determined to be the appropriate spillway design flood. The 100-year flood (1 percent probability flood) will overtop the dam. The 1 percent probability flood is one that has a 1 percent chance of being exceeded in any given year. The 10 year flood (10 percent probability flood) will not overtop the dam. The 10 percent probability flood is one that has a 10 percent chance of being exceeded in any given year.

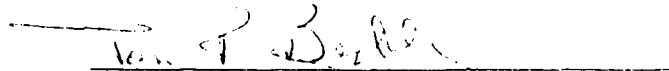
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The embankment was in good condition. Deficiencies visually observed by the inspection team were: (1) No wave protection on the upstream face; (2) principal spillway outlet channel slab was undermined; (3) slough area on left side of principal spillway outlet channel; (4) wood debris at end of principal spillway outlet channel.

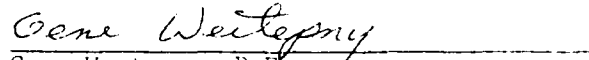
Another deficiency was the lack of seepage and stability analysis records.

It is recommended that the owners take the necessary action promptly to correct the deficiencies reported herein. A detailed discussion of these deficiencies is included in the following report.


Steven L. Brady, P.E.
Anderson Engineering, Inc.


Tom R. Beckley, P.E.
Anderson Engineering, Inc.


Dave Daniels, P.E.
Hanson Engineers, Inc.


Gene Wertepny, P.E.
Hanson Engineers, Inc.



AERIAL VIEW OF LAKE AND DAM

MISSISSIPPI-KASKASKIA-ST LOUIS RIVER BASIN

GLEN BASLER LAKE DAM
STE. GENEVIEVE COUNTY, MISSOURI
MISSOURI INVENTORY NUMBER 31382

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared By

Anderson Engineering, Inc., Springfield, Missouri
Hanson Engineers, Inc., Springfield, Illinois

Under Direction Of
St. Louis District, Corps of Engineers

For

Governor of Missouri

April, 1981

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
GLEN BASLER LAKE DAM
MISSOURI INVENTORY NO. 31095

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SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

A. Authority:

The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection be made of Glen Basler Lake Dam in Ste. Genevieve County, Missouri.

B. Purpose of Inspection:

The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and a visual inspection in order to determine if the dam poses hazards to human life or property.

C. Evaluation Criteria:

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, "Recommended Guidelines for Safety Inspection of Dams, Appendix D." These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organization, and private engineers.

1.2 DESCRIPTION OF PROJECT:

A. Description of Dam and Appurtenances:

Glen Basler Lake Dam is an earth fill structure approximately 26 feet high and 320 feet long at the crest. The appurtenant work consists of three 24 inch diameter CMP principal spillway pipes, one 24 inch diameter CMP emergency spillway pipe, and a 2 inch diameter steel dewatering pipe.

Sheet 3 of Appendix A shows a plan, profile, and typical section of the embankments.

B. Location:

The dam is located in the southeast part of Ste. Genevieve County, Missouri on a tributary of Little Saline Creek. The dam and lake are within the Minnith, Missouri 7.5 minute quadrangle sheet (Section 8, T36N, R9E - latitude 37° 50'; longitude 90° 03.7'). Sheet 2 of Appendix A shows the general vicinity.

C. Size Classification:

With an embankment height of 26 feet and a maximum storage capacity of approximately 41 acre-feet, the dam is in the small size category. The guidelines state that an embankment over 25 feet high but less than 40 feet high is in the small size category.

D. Hazard Classification:

The St. Louis District, Corps of Engineers has determined that this dam is in the high hazard potential classification. The estimated damage zone extends approximately one mile downstream of the dam. Located within this zone are four dwellings, one trailer, several barns, and a shed. The features within the damage zone were verified by the inspection team in the field.

E. Ownership:

The dam is owned by R. Dale Murphy.
The owner's address is Star Route 1, St. Marys, Missouri 63673

F. Purpose of Dam:

The dam was constructed primarily for recreation.

G. Design and Construction History:

The dam was constructed in 1972 by Floyd Williams of Star Route 1, St. Marys, Missouri. All of the construction history was obtained from Mr. Glen Basler of St. Marys, Missouri (314-883-7209) the owner of the property when the dam was constructed. Mr. Basler stated that a core trench approximately 12' wide and 10' deep was cut down into clay and filled with compacted clay.

The material for the embankment came from the lake area. Mr. Basler said that better clay was utilized on the front (upstream) slope of the dam. Compaction of the embankment was accomplished by a bulldozer and roller.

No unusual conditions were encountered during construction of the dam. Mr. Basler said that the dam was built with two 24 inch principal spillway pipes and the emergency spillway was a small earth channel at the east end of the dam. In 1973, a 24 inch diameter CMP was installed as the emergency spillway in place of the earth channel. In 1974, an additional 24 inch diameter CMP was added to the principal spillway.

Mr. Basler said he was not aware of any seepage.

H. Normal Operating Procedures:

Water level is controlled by rainfall, runoff, transpiration, evaporation, seepage, overflow through uncontrolled spillway pipes and withdrawal through the valved dewatering pipe.

1.3 PERTINENT DATA:

Pertinent data about the dam, appurtenant works, and reservoir are presented in the following paragraphs. Sheet 3 of Appendix A presents a plan, profile, and typical section of the embankment.

A. Drainage Area:

The drainage area for this dam, as obtained from the U.S.G.S. quad sheet, is approximately 115 acres.

B. Discharge at Dam Site:

- (1) All discharge at the dam site is through uncontrolled spillways.
- (2) Estimated Total Spillway Capacity at Maximum Pool (Top of Dam - El. 544.5): 65 cfs.
- (3) Estimated Capacity of Principal Spillway: 60 cfs.
- (4) Estimated Capacity of Emergency Spillway: 5 cfs.
- (5) Estimated Experience Maximum Flood at Dam Site: Unknown.
- (6) Diversion Tunnel Low Pool Outlet at Pool Elevation: Not Applicable.
- (7) Diversion Tunnel Outlet at Pool Elevation: Not Applicable.
- (8) Gated Spillway Capacity at Pool Elevation: Not Applicable.
- (9) Gated Spillway Capacity at Maximum Pool Elevation: Not Applicable.

C. Elevations:

All elevations are consistent with an assumed mean sea level elevation of 541.0 for the invert of the east principal spillway pipe. (estimated from quadrangle map).

- (1) Top of Dam: 544.5 ft., MSL
- (2) Principal Spillway Crest: 541.0 ft., MSL
- (3) Emergency Spillway Crest: 543.3 ft., MSL
- (4) Principal Spillway Pipe Invert at Outlet: 540.5 ft., MSL
- (5) Streambed at Centerline of Dam: 519.0 ft., MSL
- (6) Pool on Date of Inspection: 537.7 ft., MSL
- (7) Apparent High Water Mark: 541.5 ft., MSL
- (8) Maximum Tailwater: Not Applicable
- (9) Upstream Portal Invert Diversion Tunnel: Not Applicable
- (10) Downstream Portal Invert Diversion Tunnel: Not Applicable

D. Reservoir Lengths:

- (1) At Top of Dam: 500 ft.
- (2) At Emergency Spillway Crest: 480 ft.
- (3) At Principal Spillway Crest: 440 ft.

E. Storage Capacities:

- (1) At Top of Dam: 41 acre-ft.
- (2) At Emergency Spillway Crest: 36 acre-ft.
- (3) At Principal Spillway Crest: 28 acre-ft.

F. Reservoir Surface Areas:

- (1) At Top of Dam: 4.3 acres
- (2) At Emergency Spillway Crest: 3.8 acres
- (3) At Principal Spillway Crest: 3.0 acres

G. Dam:

- (1) Type: Rolled Earth
- (2) Length at Crest: 320 ft.
- (3) Height: 26 ft.
- (4) Top Width: 12 ft.
- (5) Side Slopes: Upstream varies 3.1 H on 1V to 3.4 H on 1V;
Downstream, varies 2.3 H on 1V to 3.2 H on 1V.
- (6) Zoning: Apparently homogeneous
- (7) Impervious Core: None
- (8) Cutoff: Key Trench Approximately 10 Ft. Into Clay
- (9) Grout Curtain: None

H. Diversion and Regulating Tunnel:

- (1) Type: Not Applicable
- (2) Length: Not Applicable
- (3) Closure: Not Applicable
- (4) Access: Not Applicable
- (5) Regulating Facilities:

I. Spillway:

1.1 Principal Spillway:

- (1) Location: Station 0+17, West End of Dam.
- (2) Type: Three 24 Inch Diameter CMP
- (3) Upstream Channel: Fairly Clear With Two Fences In Front of Spillway
- (4) Downstream Channel: Earth Cut Channel in Left Abutment With Concrete Apron In Initial Portion.

1.2 Emergency Spillway:

- (1) Location: Station 3+45 Near East End of Dam
- (2) Type: 24 Inch Diameter CMP
- (3) Upstream Channel: Clean
- (4) Downstream Channel: Open, Discharges Into Agricultural Field.

J. Regulating Outlets:

There is a two inch steel dewatering pipe located at station 1+25.
The pipe is controlled by a valve at the downstream end of the pipe.

SECTION 2 ENGINEERING DATA

2.1 DESIGN

There were no design calculations or engineering drawings prepared for the dam. No documentation of construction inspection records were available. There are no documented maintenance data.

A. Surveys:

No pre-construction or post-construction survey data were available.

Sheet 3 of Appendix A presents a plan, profile, and cross section of the dam from survey data obtained during our site inspection. The invert of the east principal spillway pipe was used as the site datum. The mean sea level elevation of 541.0 for our site datum was estimated from the Minnith, Missouri 7.5 minute quadrangle sheet.

B. Geology and Subsurface Materials:

The site is located along the eastern edge of the Ozarks geologic region of Missouri. The Ozarks are characterized topographically by hills, plateaus, and deep valleys. The most common bedrock types are dolomite, sandstone and chert. The "Geologic Map of Missouri" indicates that the bedrock in the site area consists of the Jefferson City, Cotter, Powell, and Smithville formations. The Missouri Geological Survey Office indicates that the bedrock at the site is probably of the Jefferson City formation. The Jefferson City formation consists of light brown to brown, medium to finely crystalline dolomite and argillaceous dolomite.

The "Geologic Map of Missouri" indicates several normal faults within the site area. The site is located in seismic zone 2 (moderate damage zone) but is close to the boundary of zone 3 (major damage zone see Sheet 3 of Appendix B).

The soils are of the Union-Fullerton-McGirk Soil Association and have developed from thin loess deposited over weathered material from cherty dolomite (see Leossial Thickness Map, Sheet 2 of Appendix B). Auger probes in the embankment indicate the soils to be brown clayey silts (ML).

C. Foundation and Embankment Design:

No foundation and embankment design information was available. Seepage and stability analysis apparently were not performed as required in the Corps of Engineers guidelines. Mr. Glen Basler the previous owner indicated that a core trench, 12 feet wide and 10 feet deep was excavated to a clay base. All embankment fill material was obtained from the lake bed area.

D. Hydrology and Hydraulics:

No hydrologic and hydraulic design computations are available for this dam. Based on field measurements of spillway dimensions and embankment elevations and the watershed area, lake area and storage data from U.S.G.S. quadrangle sheets, hydrologic analyses using U.S. Army Corps of Engineers guidelines were performed and appear in Appendix C.

E. Structure:

There are no structures associated with this dam.

2.2 CONSTRUCTION:

No construction inspection data are available.

2.3 OPERATION:

Normal flows would be passed by the three 24 inch diameter CMP principal spillway pipes and the 24 inch diameter CMP emergency spillway.

2.4 EVALUATION:

A. Availability:

No engineering data, seepage or stability analyses, or construction test data was available.

B. Adequacy:

The engineering data available were inadequate to make a detailed assessment of the design, construction, and operation of this structure. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

C. Validity:

To our knowledge, no valid engineering data on the design or construction of the embankment are available.

SECTION 3 VISUAL INSPECTION

3.1 FINDINGS:

A. General:

The field inspection was made on January 29, 1981. The inspection team consisted of personnel from Anderson Engineering, Inc. of Springfield, Missouri and Hanson Engineers, Inc. of Springfield, Illinois. The team members were:

Steven L. Brady - Anderson Engineering, Inc. (Civil Engineer)
Tom R. Beckley - Anderson Engineering, Inc. (Civil Engineer)
Gene Wertepny - Hanson Engineers, Inc. (Hydraulic Engineer)
Dave Daniels - Hanson Engineers, Inc. (Geotechnical Engineer)

Photographs of the dam, appurtenant structures, reservoir, and downstream features are presented in Appendix D.

B. Dam:

The embankment appears to be in good condition with grass cover noted on the upstream and downstream slopes of the embankment. The 12 foot wide crest of the embankment has a graveled access road across it. The embankment was constructed fairly straight and the vertical alignment was such that the middle of the embankment was approximately 4 feet lower than the ends.

The slopes of the embankment were relatively constant. The upstream slope varied from 3.1 H on 1V to 3.4 H on 1V and the downstream slope varied from 2.3 H on 1V to 3.2 H on 1V. No surface cracking of the embankment was noted. Both slopes of the embankment were grass covered and clear of brush and trees. No riprap was noted and an erosion bench was evident at normal water line. No sloughs, animal holes, or seepage were noted on the embankment.

The upper portion of the outlet channel of the principal spillway is lined with a concrete slab. The slab is about 25 feet long and 15 feet wide. It appears that brick has been dumped just downstream of the concrete slab. The slab is undermined at the end. The outlet channel is a cut trench in the left valley wall. There is a slough area on the left side of the outlet channel just downstream of the concrete apron. The slough is about 15 feet wide at the top and fairly shallow. There is also some wood debris at the end of the outlet channel.

There is a 2 inch steel dewatering pipe through the dam at station 1+25 with a valve at the downstream end. There is a small area of cattail growth just beyond the watering pipe outlet. No seepage was noted.

The emergency spillway pipe discharges into an agricultural field downstream of the dam. No erosion was noted in the outlet area.

Shallow auger probes of the embankment indicated the embankment soil to consist of a brown clayey silt (Unified Soil Classification System of ML).

No instrumentation (monuments, piezometers etc.) was observed.

C. Appurtenant Structures:

C.1 Principal Spillway:

The principal spillway consisted of three 24 inch diameter CMP pipes. The inlet was fairly clear except for 2 fences that acted as fish screens. The outlet was over a concrete apron and through an earth cut channel. Brick and wood debris are in the channel. A slough exists on the left wall of the outlet channel. A 2 inch steel dewatering pipe runs through the dam at station 1+25.

C.2 Emergency Spillway:

The emergency spillway consists of a 24 inch diameter CMP pipe located at the east end of the dam. The emergency spillway discharge channel is into an agricultural field.

D. Reservoir:

The watershed is primarily wooded with moderate slopes. No significant erosion or sloughing was noted. No significant sedimentation was noted and it is not considered to be a problem.

E. Downstream Channel:

The downstream channel is well defined and it is lined with brush and trees. The side slopes are gentle to moderate.

3.2 EVALUATION:

The embankment is in good structural condition. The lack of wave protection could cause continued erosion of the upstream face with time. The slough in the principal spillway outlet channel could worsen and seriously affect the capacity of the channel.

Because the 2 inch diameter pipe valve is located on the downstream side of the dam, the full head of water impounded by the dam is acting entirely through the dam. The area around the pipe outlet should be periodically inspected for seepage which might indicate a leak or rupture of the pipe and could eventually initiate a piping failure through the embankment.

SECTION 4 OPERATIONAL PROCEDURES

4.1 PROCEDURES:

There are no operating facilities. The pool is normally controlled by rainfall, runoff, and the capacity of the uncontrolled spillways.

4.2 MAINTENANCE OF DAM:

The embankment is clear of trees and brush, so it is evident that some maintenance is done.

4.3 MAINTENANCE OF OPERATING FACILITIES:

No maintenance information was obtained on the 2 inch dewatering pipe. The valve and pipe should be inspected and maintained on a regular basis.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT:

The inspection team is unaware of any existing warning system for this dam.

4.5 EVALUATION:

The lack of rip-rap on the upstream face of the dam and the principal spillway outlet channel slough could become serious problems if not corrected. A regular program of maintenance should be established.

SECTION HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES:

A. Design Data:

No hydrologic or hydraulic design computations for this dam were available.

B. Experience Data:

No record of rainfall, runoff, discharge, or reservoir stage data were available for this lake and watershed. Mr. Basler indicated that the maximum water level in the lake occurred shortly after the dam was built in early 1973. Some water passed over the emergency spillway channel that existed at that time.

C. Visual Observations:

The principal spillway pipes appear to be in good condition. The upper portion of the outlet channel is lined with a concrete slab. Erosion has occurred at the downstream end of the lining, causing undermining of the slab. Bricks have been dumped in the eroded area to stop the erosion. Some debris and wood are also present in this area. A slough exists in the left wall of the outlet channel. The outlet channel protects the embankment for spillway discharges. The downstream channel is overgrown with brush and trees. The emergency spillway discharges are into an agricultural field and away from the embankment.

D. Overtopping Potential:

The hydraulic and hydrologic analyses (using the U.S. Army Corps of Engineers guidelines and the HEC-1 computer program) were based on:
(1) a field survey of spillway dimensions and embankment elevations; and
(2) an estimate of the reservoir storage and the pool and drainage areas from the Minnith, Missouri 7.5 Minute U.S.G.S. quad sheet.

Based on the hydrologic and hydraulic analysis presented in Appendix C, the combined spillways will pass 11 percent of the Probable Maximum Flood. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The recommended guidelines from the Department of the Army, Office of the Chief of Engineers, require that this structure (small size with high downstream hazard potential) pass 50 percent to 100 percent of the PMF, without overtopping. Considering the low height of the dam (26 feet) and the small storage capacity (41 acre-ft.) 50 percent of the PMF has been determined to be the appropriate spillway design flood. The spillways will not pass a 1 percent probability flood without overtopping the dam.

Application of the probable maximum precipitation (PMF), minus losses, resulted in a flood hydrograph peak inflow of 2630 cfs. For 50 percent of the PMF, the peak inflow was 1310 cfs.

The routing of 50 percent of the PMF through the spillways and dam indicates that the dam will be overtopped by 1.5 ft at elevation 546.9. The duration of the overtopping will be 6.75 hours, and the maximum outflow will be 1210 cfs. The maximum discharge capacity of the spillways is 65 cfs. The routing of the PMF indicates that the dam will be overtopped by 2.3 ft at elevation 546.8. The maximum outflow will be 2570 cfs, and the duration of overtopping will be 10.2 hours. Overtopping of an earthen embankment could cause serious erosion and could possibly lead to failure of the structure.

SECTION 6 STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY:

A. Visual Observations:

Observed features which could adversely affect the structural stability of this dam are discussed in Sections 3.1.B and 3.2.

B. Design and Construction Data:

No design and construction data for the foundation and embankment were available. Seepage and stability analyses comparable to the requirements of the guidelines were not available, which constitutes a deficiency which should be rectified.

C. Operating Records:

No operating records have been obtained.

D. Post-Construction Changes:

The original emergency spillway channel was replaced by a 24 inch diameter CMP in 1973 and an additional 24 inch diameter CMP was added to the principal spillway pipe in 1974.

E. Seismic Stability:

The structure is located in seismic zone 2 to which the guidelines assign a moderate damage potential. It is recommended that the prescribed seismic loading for this zone be applied in stability analyses performed for this dam.

SECTION 7 ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

This Phase I inspection and evaluation should not be considered as being comprehensive since the scope of work contracted for is far less detailed than would be required for an indepth evaluation of dams. Latent deficiencies, which might be detected by a totally comprehensive investigation could exist.

A. Safety:

The embankment was in good condition. Several items were noted during the visual inspection which should be investigated further, corrected or controlled. These items are: (1) No wave protection on the upstream face; (2) principal spillway outlet slab is undermined; (3) slough area on left side of principal spillway outlet channel; (4) wood debris at end of principal spillway outlet channel.

Another deficiency was the lack of seepage and stability analyses records.

The dam will be overtopped by flows in excess of 11 percent of the Probable Maximum Flood. Overtopping of an earthen embankment could cause serious erosion and could possibly lead to failure of the structure.

B. Adequacy of Information:

The conclusions in this report were based on review of the information listed in Section 2.1, the performance history as related by others, and visual observation of external conditions.

The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analyses comparable to the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

C. Urgency:

If the deficiencies listed in paragraph A are not corrected, and if good maintenance is not provided, the embankment condition will deteriorate and possibly could become serious in the future. The item recommended in 7.2 A should be corrected promptly and the items listed in paragraph 7.2 B should be pursued without undue delay.

D. Necessity for Additional Inspection:

Based on the result of the Phase I inspection, no additional inspection is recommended.

E. Seismic Stability:

The structure is located in seismic zone 2. An earthquake of this magnitude would not generally be expected to cause severe structural damage to a well constructed earth dam of this size. However, it is recommended that the prescribed seismic loading for this zone be applied in any stability analyses performed for this dam.

7.2 REMEDIAL MEASURES:

The following remedial measures and maintenance procedures are recommended. All remedial measures should be performed under the guidance of a professional engineer experienced in the design and construction of dams.

A. Alternatives:

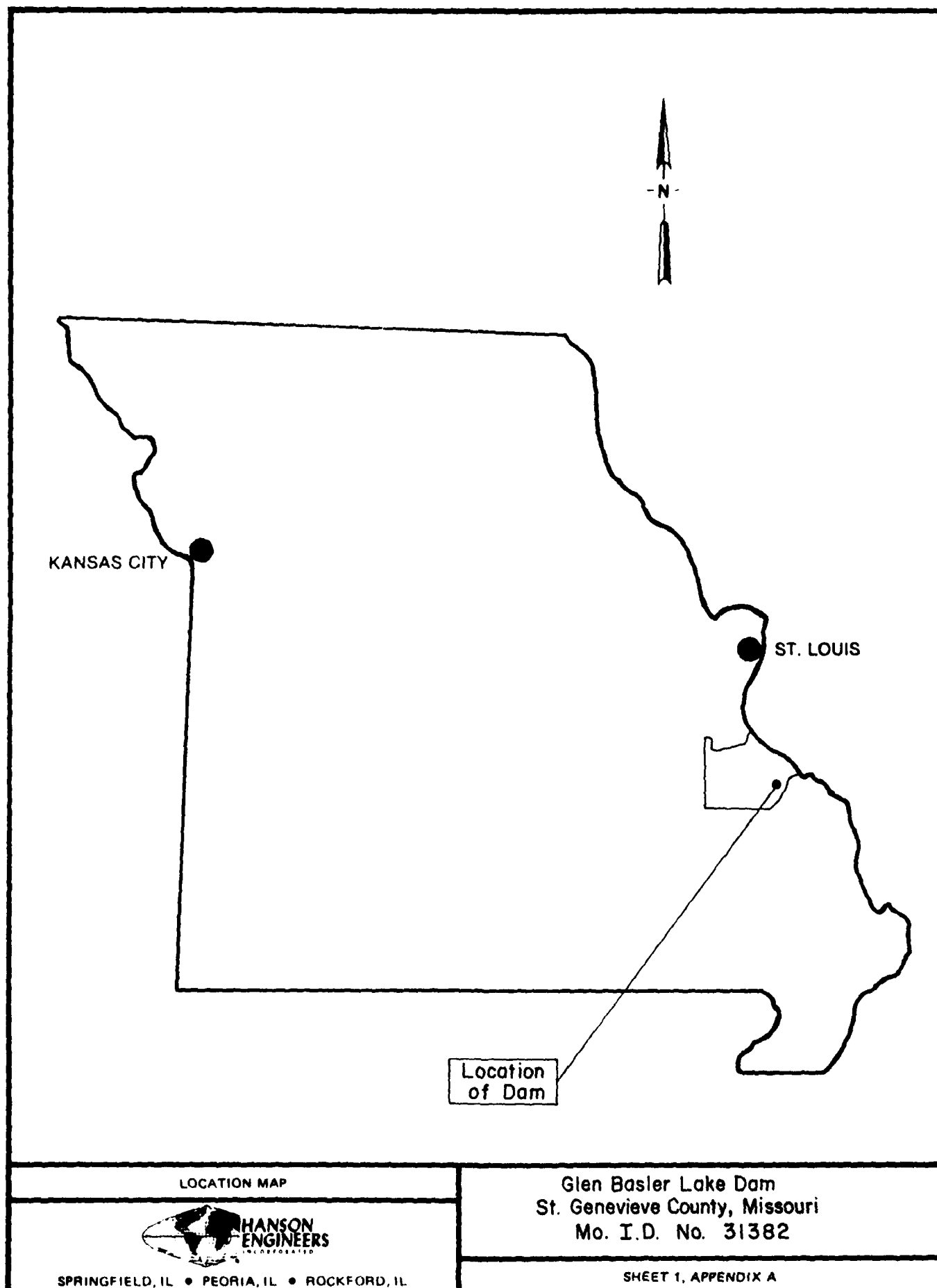
- (1) Spillway size and/or height of dam should be increased to pass 50 percent of the PMF. In either case, the spillway should be protected to prevent erosion.

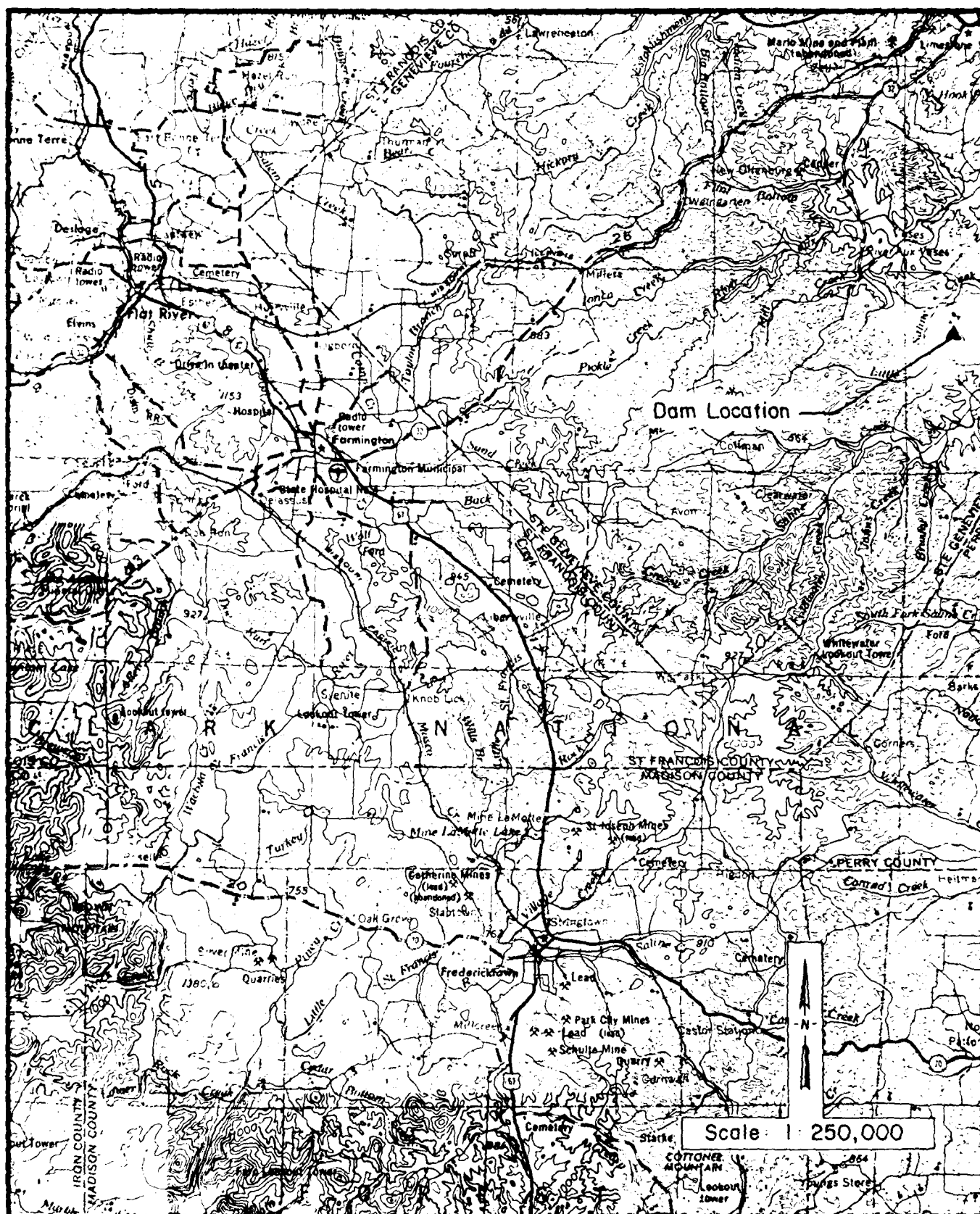
B. O & M Procedures:

- (1) Seepage and stability analyses comparable to the requirements of the recommended guidelines should be performed by an engineer experienced in the construction of dams.
- (2) A detailed inspection of the dam should be made periodically by an engineer experienced in the design and construction of dams. Records of all inspections and maintenance performed should be kept.
- (3) Wave protection should be provided for the upstream face of the dam.
- (4) The slough area in the left wall of the outlet channel should be repaired.
- (5) Principal spillway outlet concrete slab should be repaired.
- (6) Debris in outlet channel of principal spillway should be removed.
- (7) The 2 inch dewatering pipe valve at the downstream toe should be operated periodically and maintained.

APPENDIX A

Dam Location and Plans.





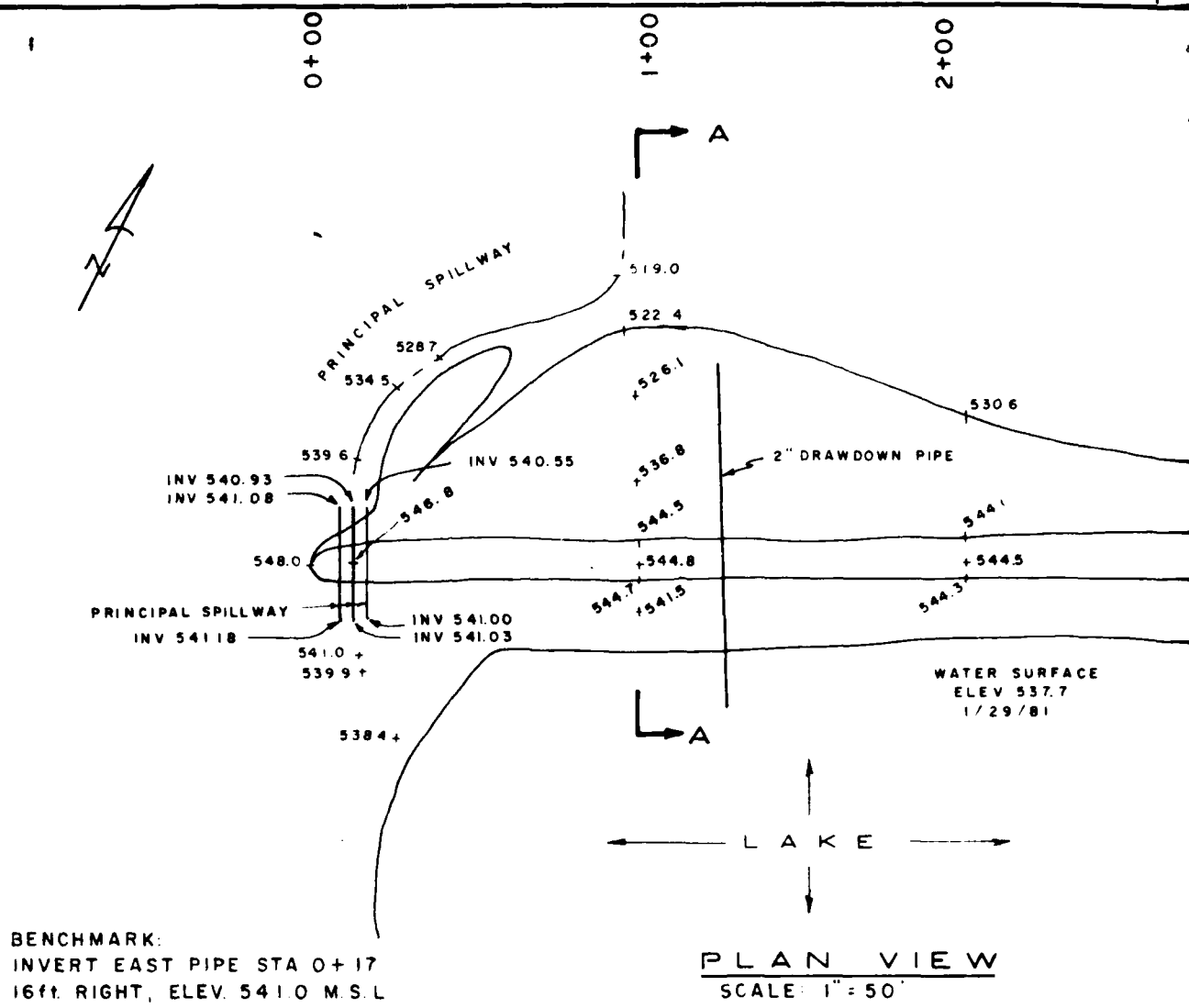
VICINITY MAP



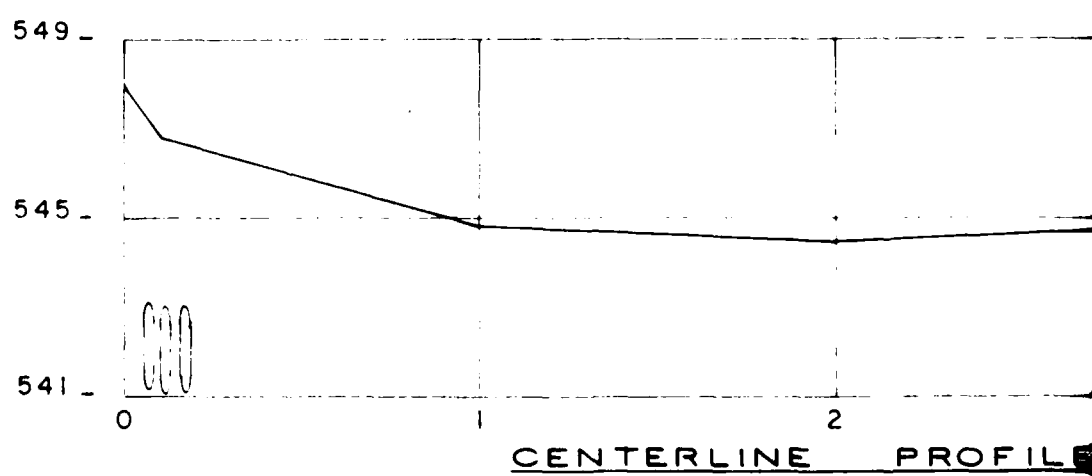
SPRINGFIELD, IL • PEORIA, IL • ROCKFORD, IL

Glen Basler Lake Dam
St. Genevieve County, Missouri
Mo. I.D. No. 31382

Sheet 2, Appendix A



BENCHMARK:
INVERT EAST PIPE STA 0+17
16ft. RIGHT, ELEV. 541.0 M.S.L



3+00

EMERGENCY SPILLWAY
PIPE

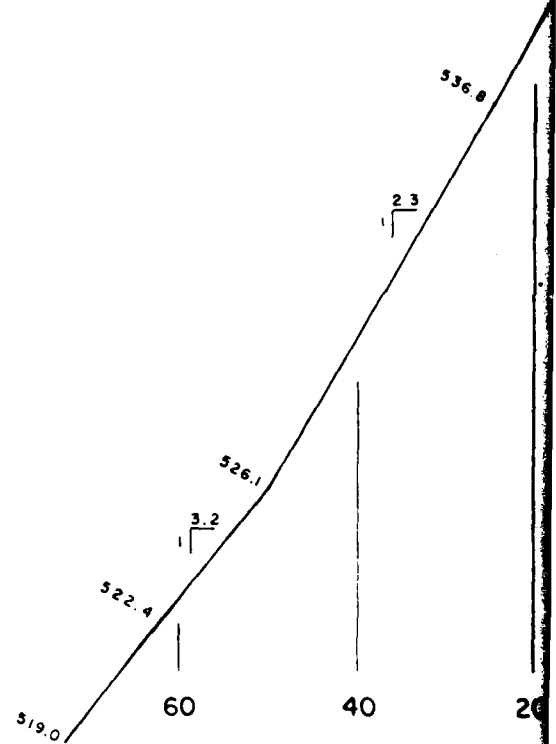
INV ELEV. 542.68

548.6

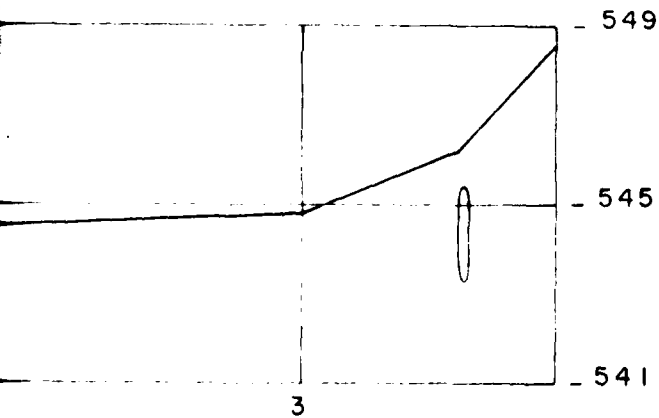
+544.8

INV. ELEV. 543.3

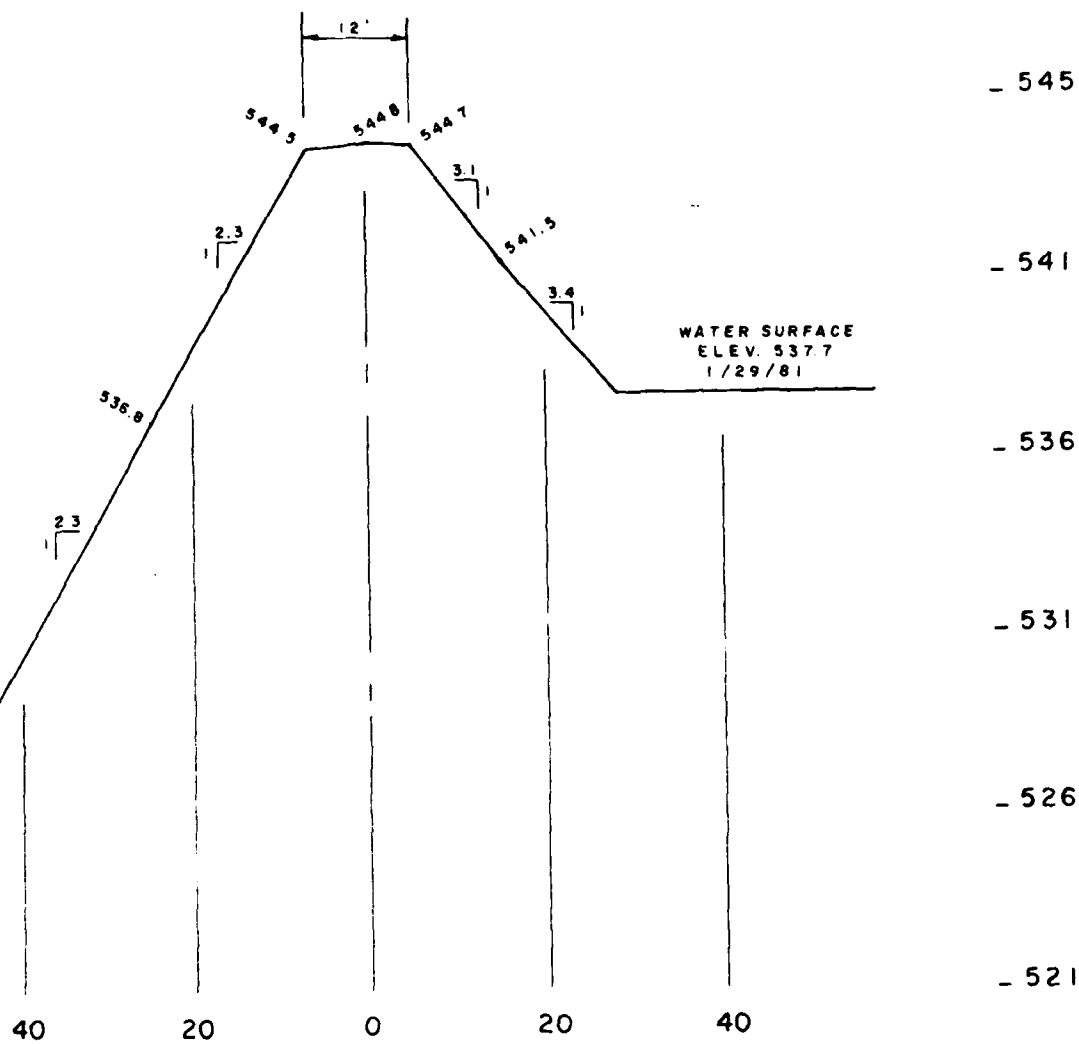
SURFACE
537.7
9/81



SECTION



PROFILE



SECTION A-A STA 1+00

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GLEN BASLER LAKE DAM

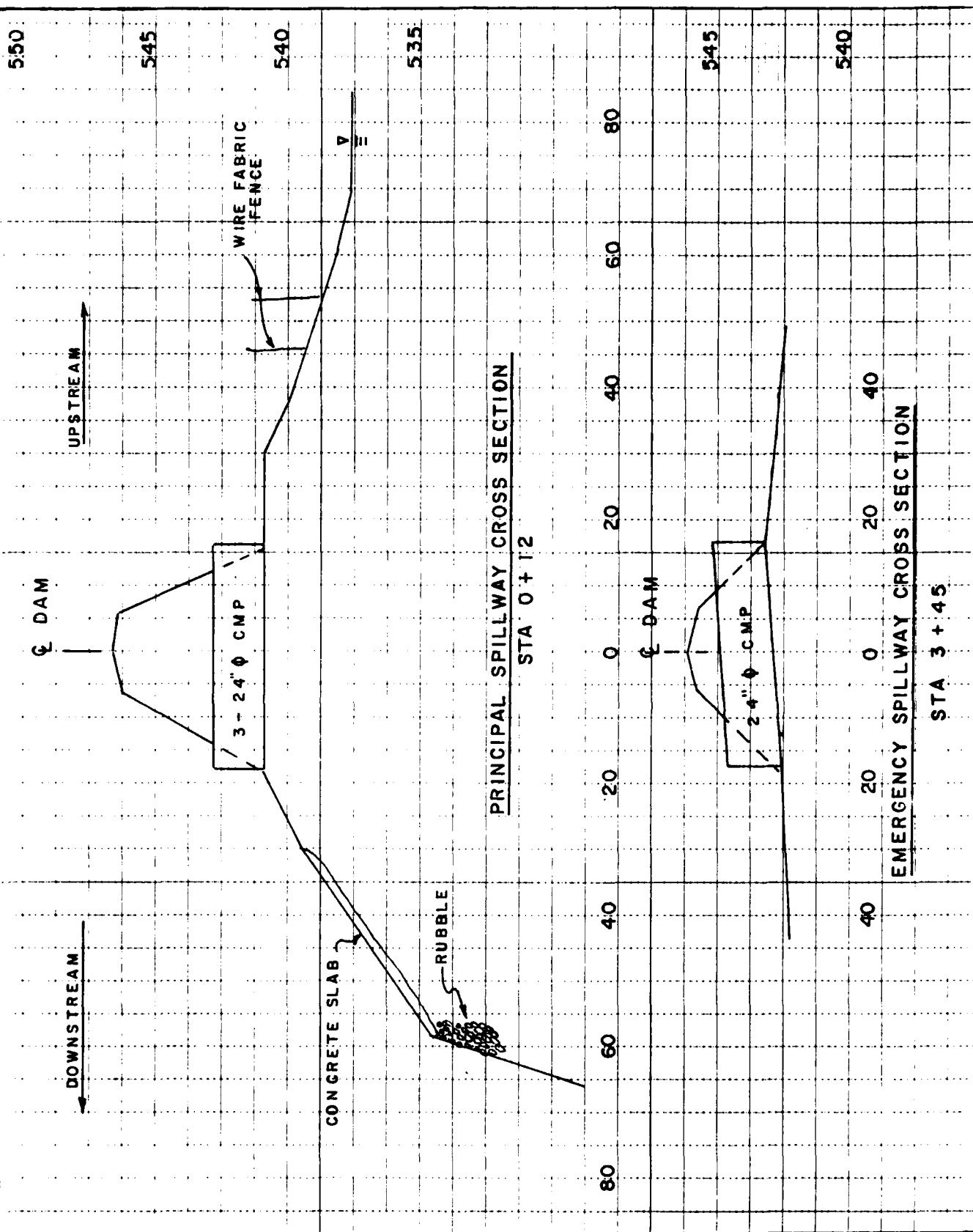
MO. No. 31382

PLAN, PROFILE AND
SECTION OF DAM

STE. GENEVIEVE COUNTY, MISSOURI

SHEET 3, APPENDIX A

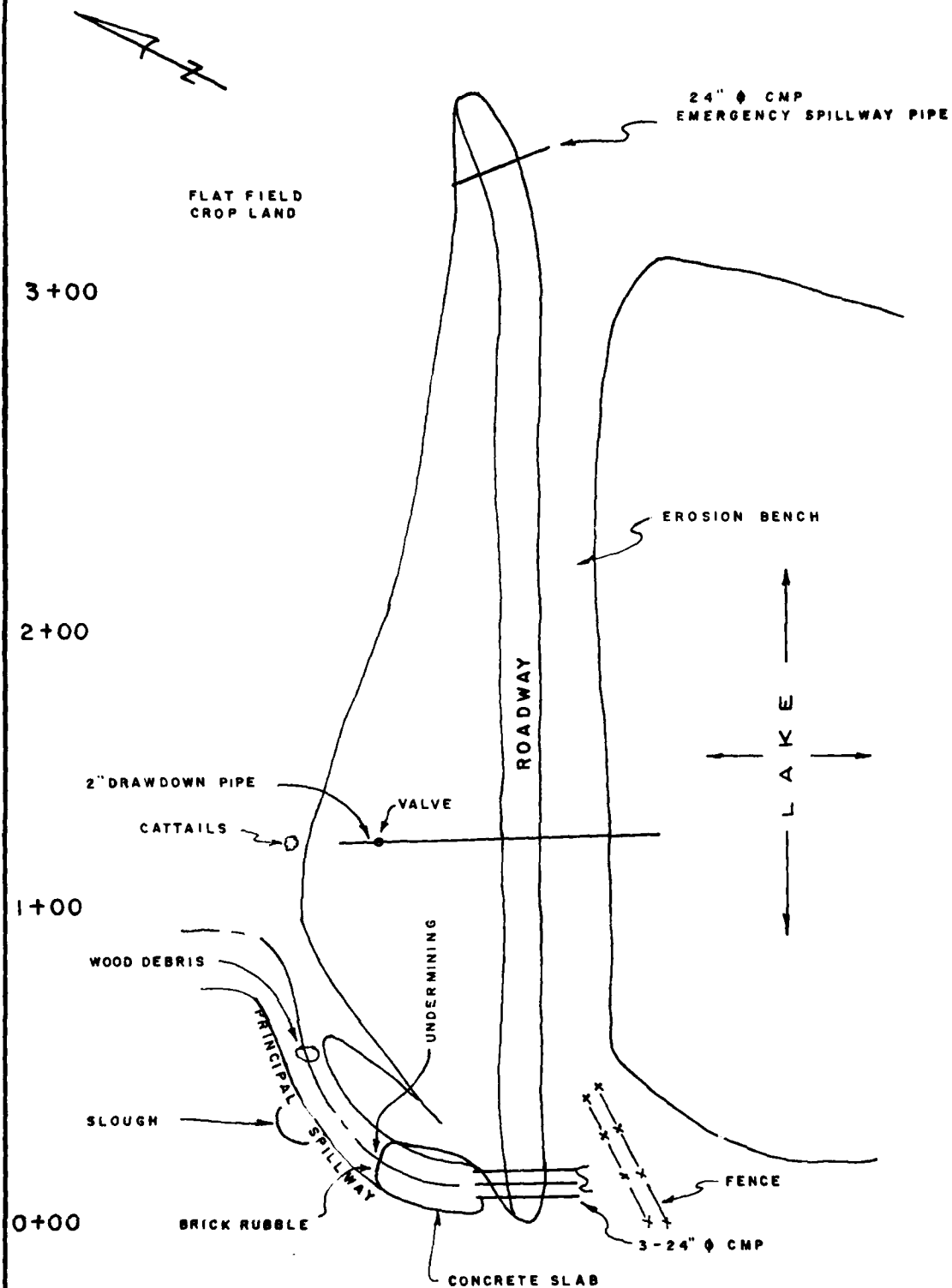
3



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PROFILE & SECTION OF SPILLWAY
GLEN BASLER LAKE DAM
STE. GENEVIEVE COUNTY, MISSOURI
MO. I. D. No. 31382

SHEET 4, APPENDIX A



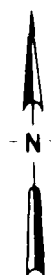
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PLAN SKETCH OF DAM
GLEN BASLER LAKE DAM
STE. GENEVIEVE COUNTY, MISSOURI
MO. I. D. No. 31382

SHEET 5 , APPENDIX A

APPENDIX B

Geology and Soils



LEGEND

GLACIATED PLAINS



WESTERN PLAINS



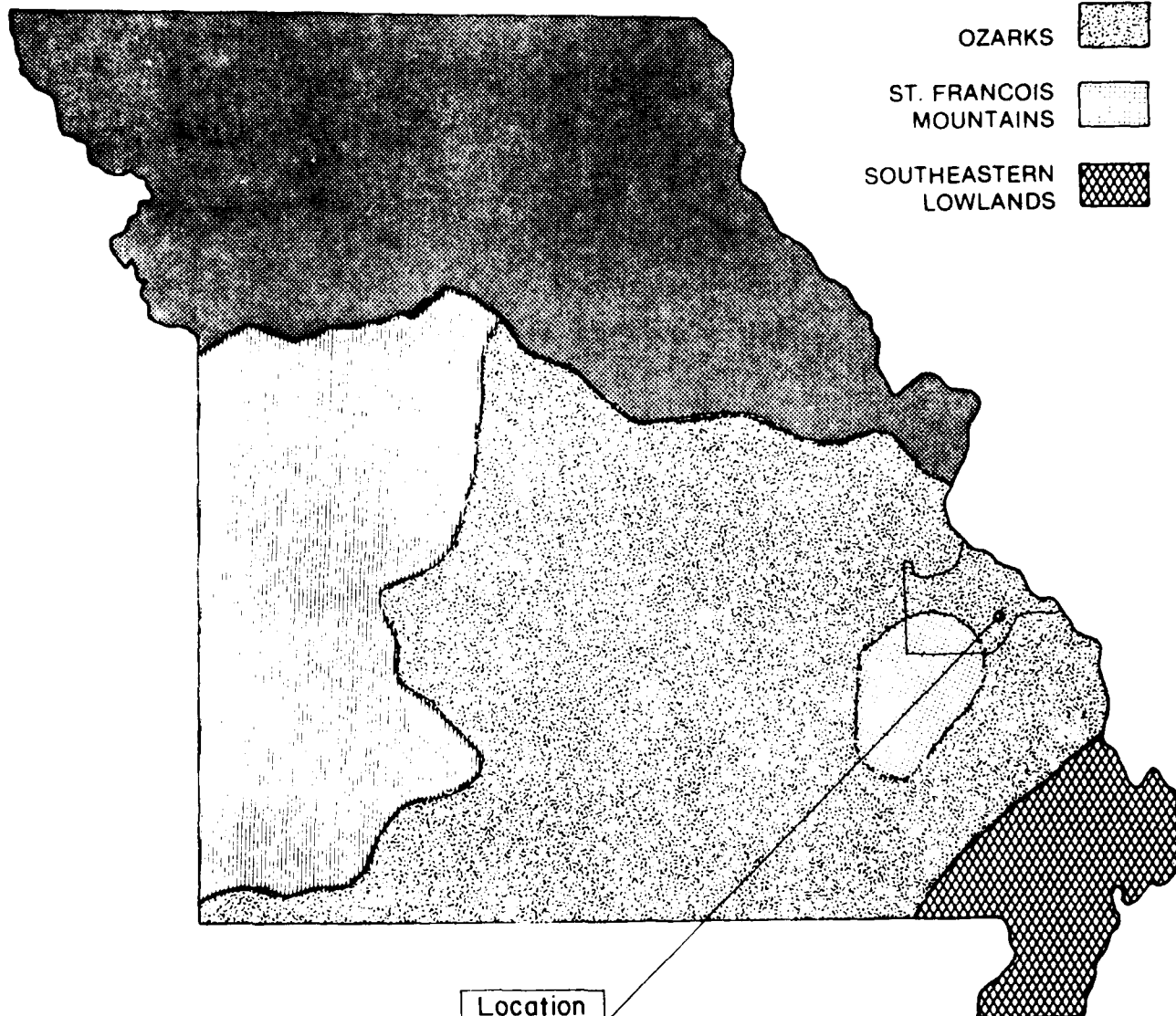
OZARKS



ST. FRANCOIS MOUNTAINS



SOUTHEASTERN LOWLANDS



Location
of Dam

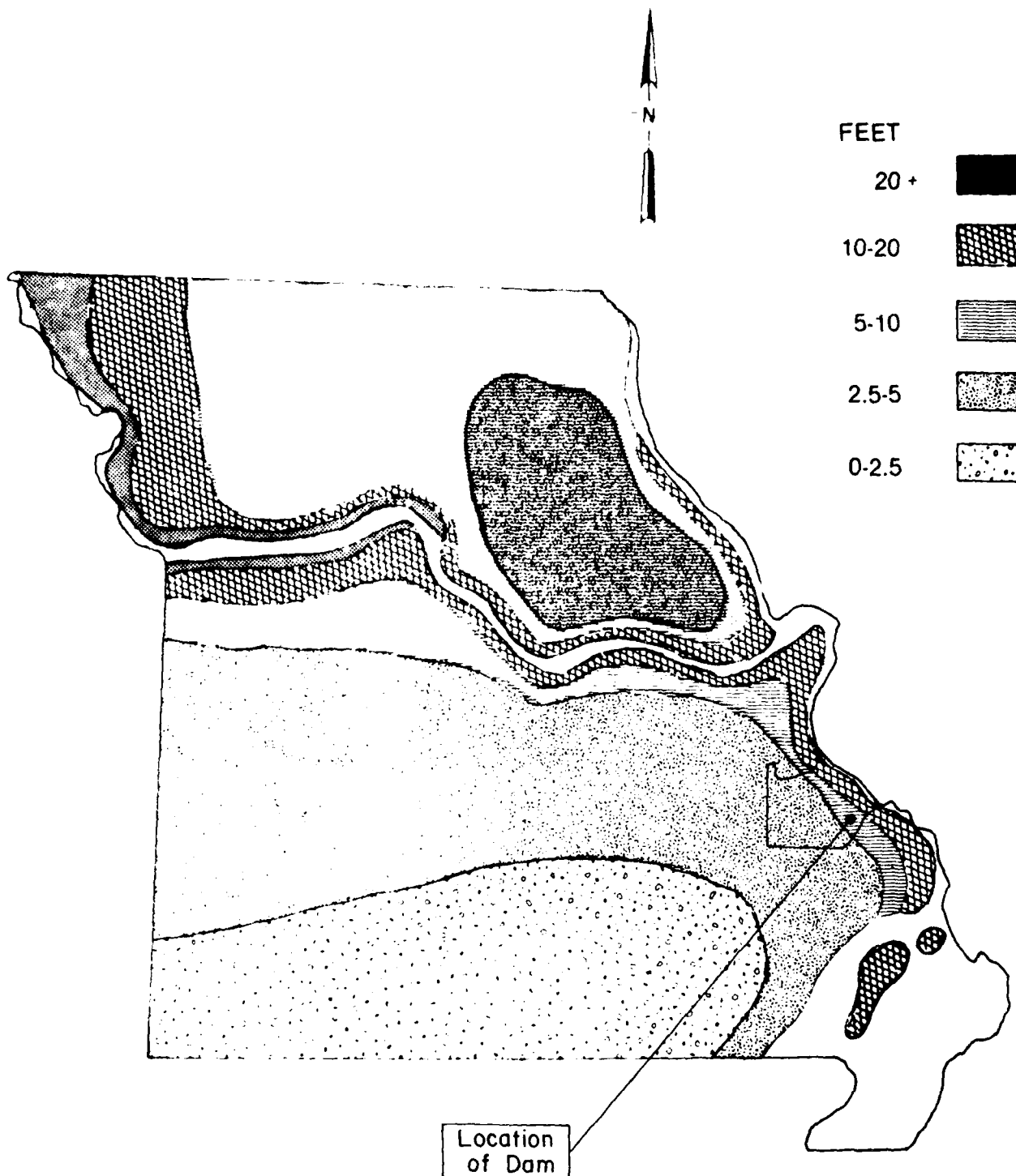
MAJOR GEOLOGIC REGIONS OF MISSOURI



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Glen Basler Lake Dam
St. Genevieve County, Missouri
Mo. I.D. No. 31382

SHEET 1, APPENDIX B



THIS PLOT IS THE PROPERTY OF THE MISSOURI DEPARTMENT OF REVENUE

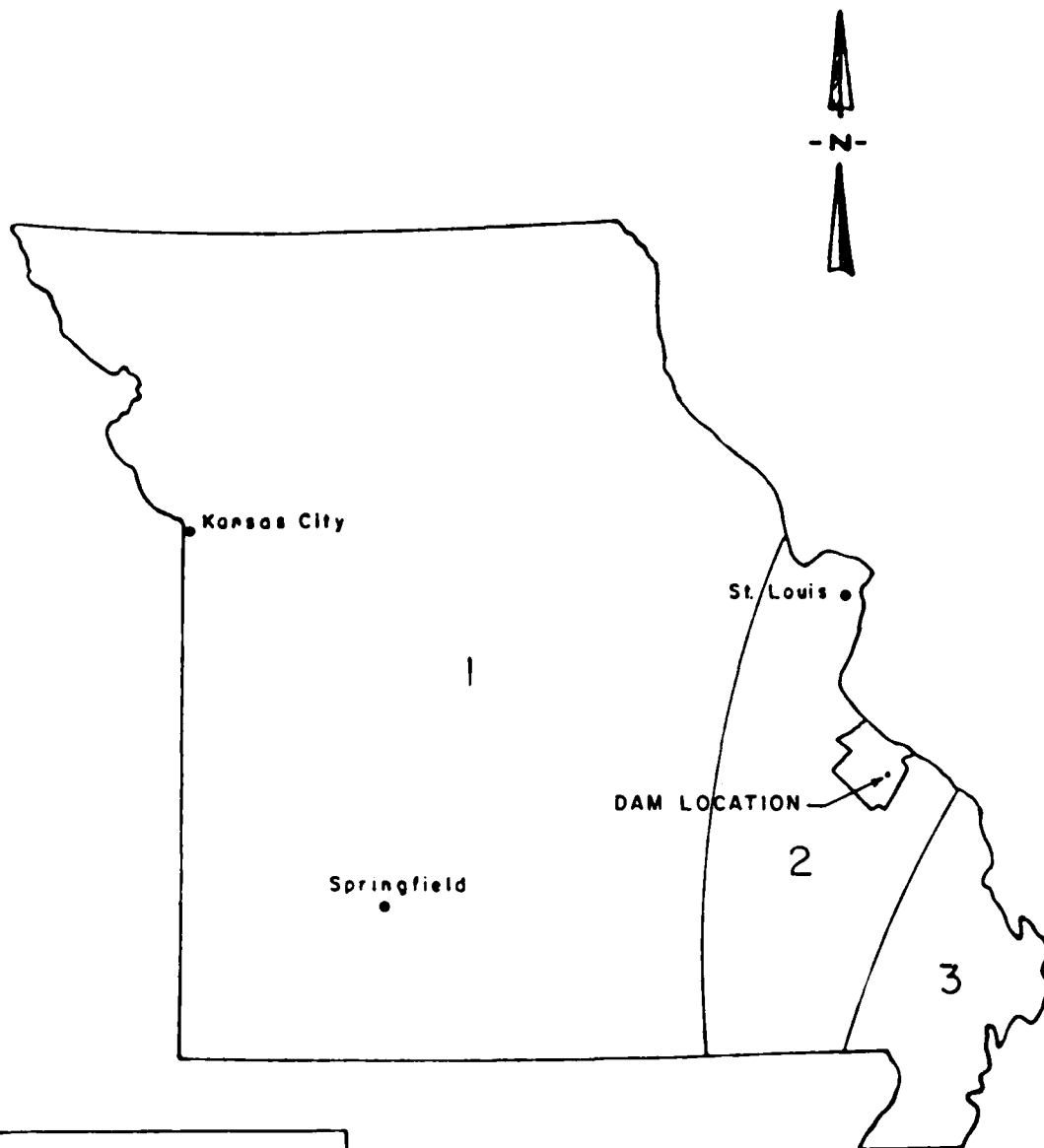


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Glen Basler Lake Dam
St. Genevieve County, Missouri
Mo. I.D. No. 31382

SHEET 2, APPENDIX B



SEISMIC PROBABILITY	
ZONE	DAMAGE
1	MINOR
2	MODERATE
3	MAJOR

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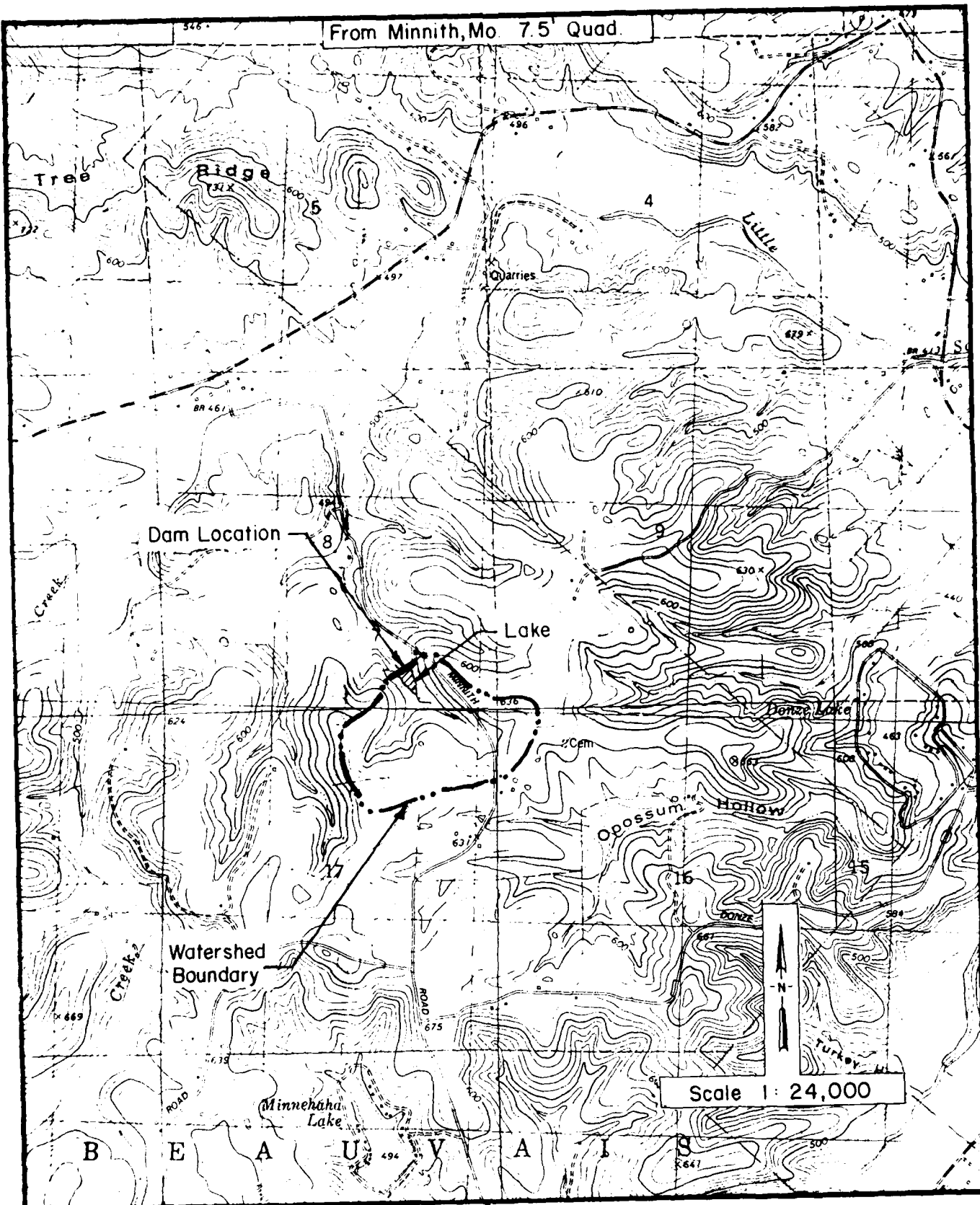
SEISMIC ZONE MAP
GLEN BASLER LAKE DAM
STE. GENEVIEVE COUNTY, MISSOURI
MO. I. D. No. 31382

SHEET 3, APPENDIX B

APPENDIX C

Overtopping Analysis

From Minnith, Mo. 7.5' Quad.



LAKE AND WATERSHED MAP



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Glen Basler Lake Dam
St. Genevieve County, Missouri
Mo. I.D. No. 31382

Sheet I, Appendix C

APPENDIX C

HYDROLOGIC AND HYDRAULIC ANALYSIS

To determine the overtopping potential, flood routings were performed by applying the Probable Maximum Precipitation (PMP) to a synthetic unit hydrograph to develop the inflow hydrograph. The inflow hydrograph was then routed through the reservoir and spillway. The overtopping analysis was accomplished using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

The PMP was determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33." Reduction factors were not applied. The rainfall distribution for the 24-hour PMP storm duration was assumed according to the procedures outlined in EM 1110-2-1411 (SPD Determination). Also, the 1 percent chance probability flood was routed through the reservoir and spillway. St. Genevieve, Missouri rainfall distribution (5 min. interval - 24 hours duration), as provided by the St. Louis District, Corps of Engineers, was used in this case.

The synthetic unit hydrograph for the watershed was developed by the computer program using the SCS method. The time of concentration was estimated using the Kirpich formula. This formula and the parameters for the unit hydrograph are shown in Table 1 (Sheet 4, Appendix C). The time of concentration was also verified from velocity estimates for the average slopes of the watershed and the main channel (Design of Small Dams, page 70, 1974 Edition).

The SCS curve number (CN) method was used in computing the infiltration losses for rainfall-runoff relationship. The CN values used for the antecedent moisture conditions (AMC), and the result from the computer output, are shown in Table 2 (Sheet 5, Appendix C).

The reservoir routing was accomplished by using the Modified Puls Method assuming the starting lake elevation at normal pool. No antecedent storm was routed in order to determine the starting elevation. It was assumed that the mean annual high water elevation corresponds with the normal pool elevation. The hydraulic capacity of the spillway was used as an outlet control in the routing. The hydraulic capacity of the spillways and the storage capacity of the reservoir were defined by the elevation-surface area-storage-discharge relationships shown in Table 3 (Sheet 5, Appendix C).

The rating curve for the spillways (see Table 4 Sheet 6, Appendix C) was determined assuming pipes with entrance and outlet control, and using charts from the U. S. Bureau of Public Roads.

The flow over the crest of the dam during overtopping was determined using the non-level dam option (\$L and \$V cards) of the HEC-1 program. The program assumes critical flow over a broad-crested weir. The lowest elevation of the crest of the dam, obtained from survey measurements, was assumed as top of dam elevation.

A summary of the routing analysis for different ratios of the PMF is shown in Table 5 (Sheet 7, Appendix C). The result of the routings indicates that the spillway will pass the 10 percent probability flood without overtopping the dam. The 1 percent probability flood will cause overtopping of the dam.

The computer input data, a summary of the output data, and a plot of the inflow-outflow hydrograph for the PMF are presented on Sheets 8, 9, and 10 of Appendix C.

TABLE 1
SYNTHETIC UNIT HYDROGRAPH

Parameters:

Drainage Area (A)	0.18	sq miles
Length of Watercourse (L)	0.44	miles
Difference in elevation (H)	100	ft
Time of concentration (Tc)	0.17	hrs
Lag Time (Lg)	0.10	hrs
Time to peak (Tp)	0.14	hrs
Peak Discharge (Qp)	620	cfs
Duration (D)	5	min.

<u>Time (Min.)(*)</u>	<u>Discharge (cfs)(*)</u>
0	0
5	394
10	583
15	256
20	100
25	38
30	15
35	6
40	2

(*) From the computer output

FORMULA USED:

$$T_c = \left(\frac{11.9 L^3}{H} \right)^{0.385}$$

Kirpich Formula.
From California Culverts Practice, California
Highways and Public Works, September, 1942.

$$L_g = 0.6 T_c$$

$$T_p = \frac{D}{2} + L_g$$

$$Q_p = \frac{484 A \cdot Q}{T_p}$$

Q = Excess Runoff = 1 inch

TABLE 2
RAINFALL-RUNOFF VALUES

<u>Selected Storm Event</u>	<u>Storm Duration (Hours)</u>	<u>Rainfall (Inches)</u>	<u>Runoff (Inches)</u>	<u>Loss (Inches)</u>
PMP	24	34.1	32.1	2.0
1% Prob. Flood	24	7.1	4.0	3.1
10% Prob. Flood	24	5.0	2.3	2.7

Additional Data:

- 1) Soil Conservation Service Soil Group C
- 2) Soil Conservation Service Runoff Curve CN = 85 (AMC III) for the PMF
- 3) Soil Conservation Service Runoff Curve CN = 71 (AMC II) for the
1 percent probability flood
- 4) Percentage of Drainage Basin Impervious 5 percent

TABLE 3
ELEVATION, SURFACE AREA, STORAGE AND DISCHARGE RELATIONSHIPS

<u>Elevation (feet-MSL)</u>	<u>Lake Surface Area (acres)</u>	<u>Lake Storage (acre-ft)</u>	<u>Spillway Discharge (cfs)</u>
519.0	0	0	-
*541.0	3.0	28	0
**543.3	3.8	36	42
***544.5	4.3	41	65
550.0	6.3	70	138
560.0	10.0	-	-

*Principal spillway crest elevation

**Emergency spillway crest elevation

***Top of dam elevation

The above relationships were developed using data from the USGS Minnith, Missouri 7.5 minute quadrangle map with a 20 ft contour interval, and the field measurements.

TABLE 4

SPILLWAYS RATING CURVE

<u>Reservoir Elevation</u> (MSL)	<u>Principal Spillway</u> (cfs)	<u>Emergency Spillway</u> (cfs)	<u>Total Discharge</u> (cfs)
*541.0	0	-	0
542.0	11	-	11
543.0	30	-	30
**543.3	42	0	42
544.0	48	3	51
***544.5	60	5	65
545.0	66	9	75
546.0	78	16	94
547.0	84	21	105
548.0	93	24	117
550.0	108	30	138

*Principal spillway crest elevation

**Emergency spillway crest elevation

***Top of dam elevation

Method Used: Charts for corrugated-metal pipe ($n = 0.024$) with entrance and outlet control from the U.S. Bureau of Public Roads.

TABLE 5
RESULTS OF FLOOD ROUTINGS

Ratio of PMF	Peak Inflow (cfs)	Peak Lake Elevation (ft, MSL)	Total Storage (acre-ft)	Peak Outflow (cfs)	Depth (ft) Over Top of Dam
-	0	*541.0	28	0	-
0.10	263	544.4	41	63	0
0.15	394	545.0	44	230	0.5
0.20	525	545.3	45	435	0.8
0.25	657	545.5	46	559	1.0
0.30	788	545.6	47	683	1.1
0.40	1,051	545.8	48	947	1.3
0.50	1,310	546.0	49	1,210	1.5
0.75	1,970	546.4	51	1,886	1.9
1.00	2,630	546.8	53	2,570	2.3

The percentage of the PMF that will reach the top of the dam is about 11 percent.

*Principal spillway crest elevation
Top of dam elevation = 544.5

288 5

1

PMF RATIOS
INPUT DATA

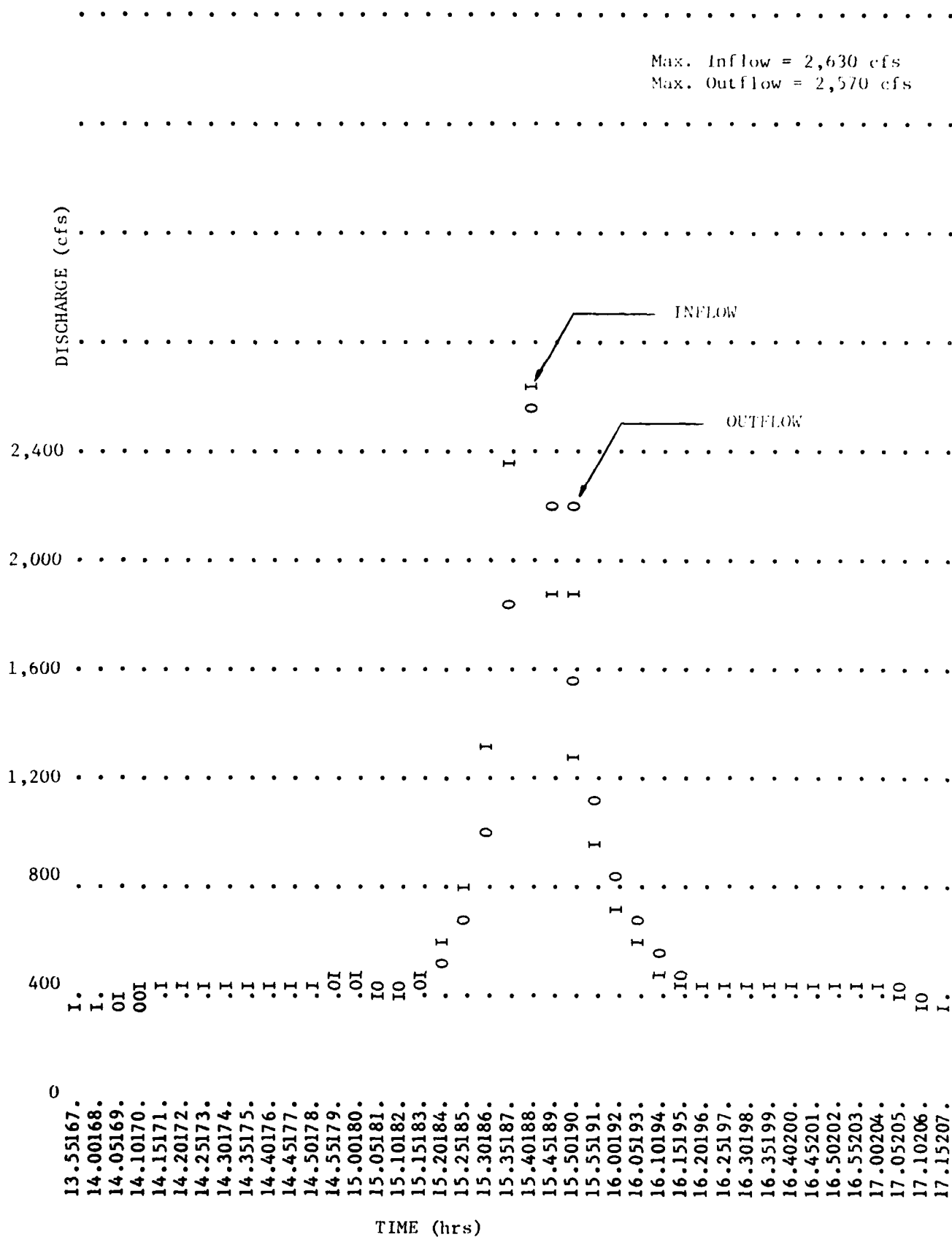
PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
HYDROGRAPH AT	1	0.18	1	0.10	0.15	0.20	0.25	0.30	0.40	0.50	0.75	1.00
	(	0.47)	(	263.	394.	525.	657.	788.	1051.	1314.	1970.	2627.
ROUTED TO	2	0.18	1	63.	230.	435.	559.	683.	947.	1214.	1886.	2565.
	(	0.47)	(	1.78)	6.50)	12.32)	15.83)	19.33)	26.81)	34.37)	53.42)	72.62)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM				
ELEVATION		541.00	541.00	544.50				
STORAGE		28.	28.	41.				
OUTFLOW		0.	0.	65.				
PMF RATIOS OUTPUT DATA	RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
	0.10	544.42	0.00	41.	63.	0.00	16.08	0.00
	0.15	545.04	0.54	44.	230.	2.00	15.83	0.00
	0.20	545.32	0.82	45.	435.	3.08	15.75	0.00
	0.25	545.46	0.96	46.	559.	4.33	15.75	0.00
	0.30	545.58	1.08	47.	683.	5.08	15.67	0.00
	0.40	545.81	1.31	48.	947.	6.08	15.67	0.00
	0.50	546.01	1.51	49.	1214.	6.75	15.67	0.00
	0.75	546.44	1.94	51.	1886.	7.83	15.67	0.00
	1.00	546.81	2.31	53.	2565.	10.17	15.67	0.00

PMF RATIOS
OUTPUT DATA



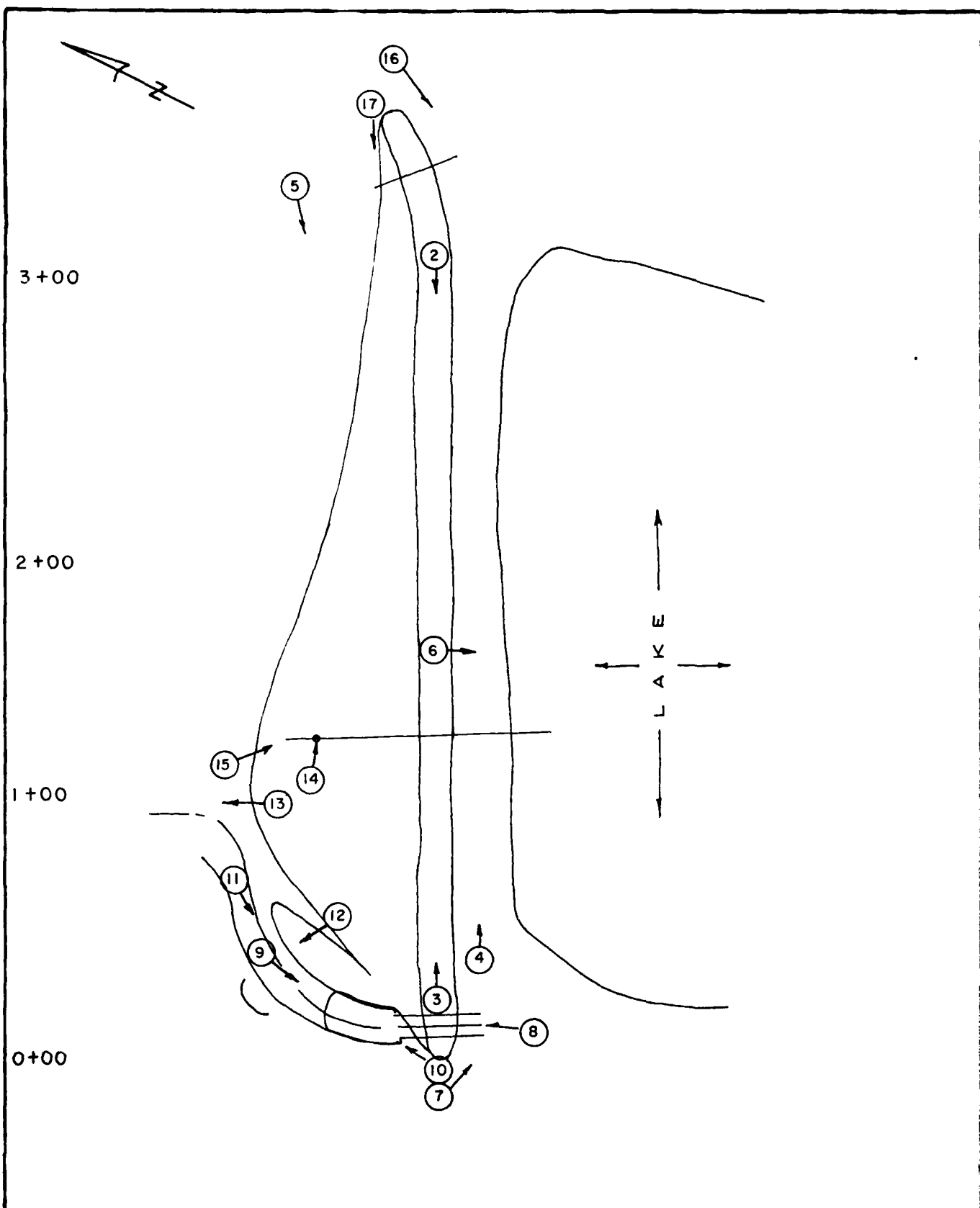
INFLOW-OUTFLOW HYDROGRAPH
FOR THE PMF

APPENDIX D

Photographs

LIST OF PHOTOGRAPHS

<u>Photo No.</u>	<u>Description</u>
1	Aerial (looking South)
2	Crest of Dam (looking West)
3	Crest of Dam (looking East)
4	Upstream Face of Dam (looking East)
5	Downstream Face of Dam (looking Southwest)
6	Reservoir Watershed (looking Southeast)
7	Principal Spillway Inlet Area
8	Principal Spillway Inlet Area
9	Undermining of Principal Spillway Concrete Slab
10	Principal Spillway Outlet Channel
11	End of Principal Spillway Outlet Channel
12	Slough in Outlet Channel Wall
13	Downstream Channel
14	Watering Pipe Valve
15	Discharge End of Watering Pipe
16	Emergency Spillway Inlet Area
17	Emergency Spillway Outlet Area
18	Downstream Hazard Feature
19	Downstream Hazard Feature
20	Downstream Hazard Feature



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SHEET 2 , APPENDIX D



